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forces (in the case of the T2SCN), and the stiffness of the cancellous bone and cortical shell contribute to the different mechanisms of load transfer that can occur in these devices.

This paper shows some recent work that examines variations in cortical shell thickness, cancellous bone modulus, and the compression force from condylar bolts. A significantly reduced cortical thickness is used while a range of cancellous bone moduli representing good quality bone and weak osteoporotic bone are examined.

The model examines both strength and stiffness. In general the pre-compression from the condylar bolts (T2SCN) produces localised compressive stress in the region adjacent to the end washer, but can provide a stiffer construct for subsequent loading. However, this outcome is also dependent on the quality of the cancellous bone adjacent to the nail. With low modulus cancellous bone cortical engagement may restrict the friction developed between bone and nail.

Under torsion, the nail constructs are always more effective than side plate constructs, and generally the locked nail provides good load-carrying capacity against torsion loads.

Keywords: Finite element modelling; Fracture fixation; Distal femur.

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1A.56

A novel form of electrical stimulation increases osteoblast activity: potential implications for enhanced fracture healing

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Delayed facture repair and bony non-unions pose a clinical challenge. Understandably, novel methods to enhance bone healing have been studied by researchers worldwide. Electrical stimulation (ES) has shown to be effective in enhancing bone healing, however the best wave form and mechanism by which it stimulates osteoblasts remains unknown. Interestingly, it is considered that osteoblast activity depends on specific waveforms applied. Therefore, the aim of this study was to evaluate whether particular waveforms have a differential effect on osteoblast activity. An osteoblast cell line was electrically stimulated with either capacitive coupling (CC) or a novel degenerate wave (DW) using a unique *in vitro* ES system. Following application of both waveforms, the extent of cytotoxicity, proliferation, differentiation and mineralisation of the osteoblasts were assessed using various assays. Differentiation and mineralization were further analysed using quantitative real-time PCR (qRT PCR) and immunocytochemistry (ICC). DW stimulation significantly enhanced the differentiation of the osteoblasts compared to CC stimulation, with increased protein and gene expression of alkaline phosphatase and type 1 collagen at 28 h ($p < 0.01$). DW significantly enhanced the mineralization of the osteoblasts compared to CC with greater Alizarin Red S staining and gene expression of osteocalcin, osteonectin, osteopontin and bone sialoprotein at 28 h ($p < 0.05$). Moreover, immunocytochemical assays showed higher osteocalcin expression after DW stimulation compared to CC at 28 h. In conclusion, we have shown that ES waveforms enhanced osteoblast activity to different extent but importantly demonstrate for the first time that DW stimulation to provide a secure, controlled and effective application for bone healing. These findings have significant implications in the clinical management of fracture repair and bone non-unions.

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Can DCP and LCP plates generate more compression?

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Aims: This is a biomechanical study aiming to assess the advantage in using more than one eccentric screw in DCP and LCP fixation, the appropriate order of their insertion, the advantage in using different drill guides in DCP fixation, and compare the compression generated by the DCP and LCP.

Methods: A customized load cell placed in a transverse osteotomy performed on synthetic generic bone models was used to measure compression. The staring pressure across the osteotomy site was standardized to allow comparison. 4.5 mm narrow DCP and LCP plates were used for fixation. The compression screws were inserted in two sequences: all on the compression side, or alternating between the initial compression and neutral sides. Loading and universal drill guides were compared in DCP fixation.

Results: A second compression screw increases compression significantly in both sequences ($p = 0.002$). In the DCP, a third compression screw improved compression only when placed in alternating sequence ($p = 0.002$). Fourth compression screw resulted in no significant compression ($p = 0.23$) and loss of reduction. The universal guide generated higher compression than the loading guide ($p = 0.002$).

There was no significant difference in the compression generated by the first or second eccentric screws in DCP and LCP plate fixation ($p = 0.28, 0.25$).

Conclusion: Fracture compression can be improved by using extra eccentric screws in LCP and DCP, and the universal drill guide in DCP fixation. Although the compression hole in the LCP is shorter, it generates compression comparable to the DCP.

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Extraction of high numbers of mesenchymal stem cells (MSCs) from intramedullary cavities of long bones

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Introduction: Iliac crest bone marrow aspirate (ICBMA) is frequently cited as the 'gold-standard' source of MSCs. It was the first location MSCs were identified and its ease of access/handling have encouraged its use as the standard. Previous studies have suggested that MSCs are resident in the intramedullary (IM) cavities of long-bones. However, a comparative assessment in terms of number, phenotype and differentiation capacity with matched ICBMA has not yet been performed.